

INSTRUMENT CENTER

ORTEC
INCORPORATED
AN  **EG&G** COMPANY

INSTRUMENT CENTER

Model 772/772H Counters

Operating and Service Manual

MP MASTER



MA29030

ORTEC 772/772H COUNTERS

Manual Change Sheet

ECN 772-1

January 11, 1974

On Schematic 772-0101-S1, change the identification of IC1 from
7448 to MSD101.

In the Replaceable Parts List starting on page 12, change the following line:

IC1 9079 66153 IC - MSD101

----- Monsanto

INSTRUMENT CENTER

ORTEC

**Model 772/772H
Counters**

Operating and Service Manual



Digitized by the Internet Archive
in 2026

https://archive.org/details/manualsplus_13208

CONTENTS

	Page
WARRANTY	v
PHOTOGRAPHS	vi
1. DESCRIPTION	1
2. SPECIFICATIONS	2
2.1. Performance	2
2.2. Indicators	2
2.3. Controls	2
2.4. Connectors	2
2.5. Option	2
2.6. Electrical and Mechanical	2
2.7. Accessory Included	3
3. INSTALLATION	3
3.1. General	3
3.2. Connection to Power	3
3.3. Counter Interconnection	3
3.4. Signal Connections	4
4. OPERATING INSTRUCTIONS	5
4.1. Front Panel Controls and Indicators	5
4.2. Initial Operation of Counter	5
4.3. Counting Setup With One Counter	6
4.4. Counting Setup With Multiple Counter-Timer Modules	6
4.5. Printing Systems	6
5. CIRCUIT DESCRIPTION	8
5.1. General	8
5.2. Positive Input Circuit	8
5.3. Negative Input Circuit	8
5.4. Gating	8
5.5. Counting Register	9
5.6. Scanner	9
5.7. Decoder and Display	9
5.8. Printing Circuit	9
5.9. Master/Norm/Slave Circuits	10
5.10. Local Reset	10
5.11. Power Supplies	10
6. MAINTENANCE	11
6.1. General	11
6.2. Fuse Replacement	11
6.3. Factory Repair	11
APPENDIX	12

Replaceable Parts List

Schematic

772-0101-S1

ILLUSTRATIONS

	Page
Fig. 3.1. Counter Interconnection for System Operation	3
Fig. 3.2. Detail of 772-C1 Printing System Cable	3
Fig. 4.1. Signal Sequence for Transferring Data for 705 849 from a Printing Scaler to the Printout Control	7
Fig. 5.1. Block Diagram of ORTEC 772 Counter	8

STANDARD WARRANTY FOR ORTEC INSTRUMENTS

ORTEC warrants its instruments other than preamplifier FET input transistors, vacuum tubes, fuses, and batteries to be free from defects in workmanship and materials for a period of twelve months from date of shipment provided that the equipment has been used in a proper manner and not subjected to abuse. Repairs or replacement, at ORTEC option, will be made on in-warranty instruments, without charge, at the ORTEC factory. Shipping expense will be to the account of the customer except in cases of defects discovered upon initial operation. Warranties of vacuum tubes and semiconductors made by their manufacturers will be extended to our customers only to the extent of the manufacturers' liability to ORTEC. Specially selected vacuum tubes or semiconductors cannot be warranted. ORTEC reserves the right to modify the design of its products without incurring responsibility for modification of previously manufactured units. Since installation conditions are beyond our control, ORTEC does not assume any risks or liabilities associated with methods of installation or with installation results.

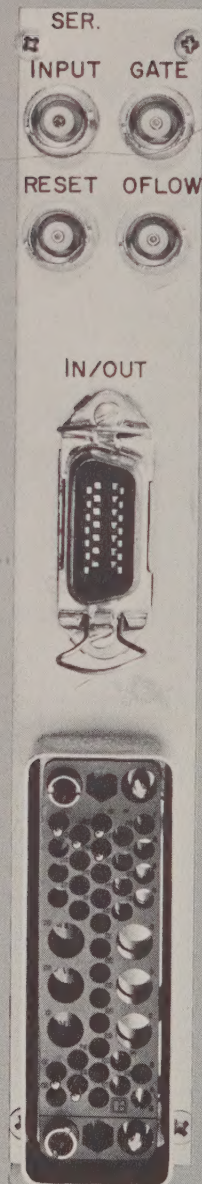
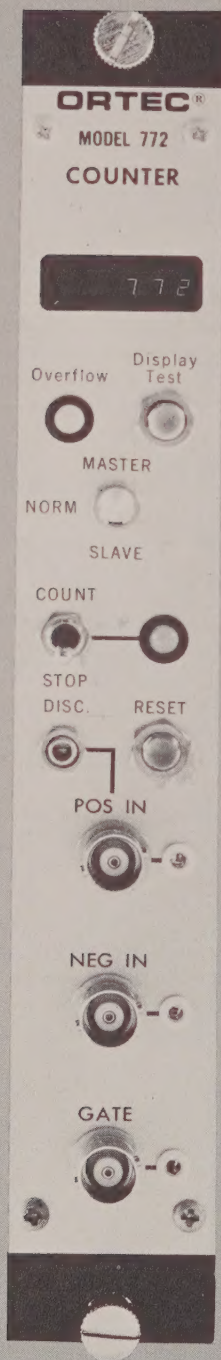
QUALITY CONTROL

Before being approved for shipment, each ORTEC instrument must pass a stringent set of quality control tests designed to expose any flaws in materials or workmanship. Permanent records of these tests are maintained for use in warranty repair and as a source of statistical information for design improvements.

ORTEC must be informed in writing of the nature of the fault of the instrument being returned and of the model and serial numbers. Failure to do so may cause unnecessary delays in getting the unit repaired. Our standard procedure requires that instruments returned for repair pass the same quality control tests that are used for new-production instruments. Instruments that are returned should be packed so that they will withstand normal transit handling and must be shipped **PREPAID** via Air Parcel Post or United Parcel Service to the nearest ORTEC repair center. Instruments damaged in transit due to inadequate packing will be repaired at the sender's expense, and it will be the sender's responsibility to make claim with the shipper. Instruments not in warranty will be repaired at the standard charge unless they have been grossly misused or mishandled, in which case the user will be notified prior to the repair being done. A quotation will be sent with the notification.

DAMAGE IN TRANSIT

Shipments should be examined immediately upon receipt for evidence of external or concealed damage. The carrier making delivery should be notified immediately of any such damage, since the carrier is normally liable for damage in shipment. Packing materials, waybills, and other such documentation should be preserved in order to establish claims. After such notification to the carrier, please notify ORTEC of the circumstances so that we may assist in damage claims and in providing replacement equipment if necessary.



ORTEC 772 and 772H COUNTERS

1. DESCRIPTION

The 772 Counter is a general-purpose 6-decade scaler that accepts and counts NIM-standard fast negative logic pulses, slow positive logic pulses, or positive analog pulses. An input discriminator is built into each of the input circuits. For the negative input circuit the discriminator has a fixed threshold at -250 mV. For the positive input circuit the discriminator level is adjustable through a range of 0.1 to 10 V. An input gate is also included to permit automatic control with timed counting intervals and/or to permit counting of coincidence events.

The 772 data can be printed, together with data from any other ORTEC printing modules, by an ORTEC 777 Line Printer or, through an ORTEC 432A Printout Control, by an ORTEC 222 Teletype.

This module is designed for use either as a single Counter or as one of up to 50 Counters that are all operated in a complex counting system with or without data printout. When an ORTEC 773 Timer-Counter is included in the system, it can furnish preset time control for counting intervals in all the other modules in the system, and the time information can be included in the printed record or can be eliminated as desired.

The 772 is packaged in a NIM-standard single-width module. It includes all the connectors and controls that will be used for either manual or automatic operation and indicates the accumulated count with 7-segment light-emitting diodes (LED) in a direct-reading display with automatic blanking of insignificant zeros.

A gate indicator, which is also an LED, lights to show when the 772 is in a counting condition. The gate is controlled by the manual Count/Stop switch, by the gate signal input circuit with connectors on both the front and rear panels, and by a common line signal through the standard ORTEC printing loop In/Out connector on the rear panel.

The Counter overflows at 10^6 counts and continues to count beyond this level. If the Counter overflows, an LED

on the front panel lights to show this condition; the indicator remains lit from the first overflow until the unit is reset. At each overflow an output pulse is also furnished through a rear panel connector and may be used for connection into another Counter for an increased counting capacity.

Reset is generated automatically when power is first applied to the unit and can be provided manually or by a signal through a rear panel BNC connector or through a common line in the standard ORTEC printing loop through the In/Out connector on the rear panel.

The seven segments in each of the six characters of the digital display can be tested at any time by pressing the Display Test switch on the front panel. When this switch is pressed, all seven segments in each digit should light to provide a reading of 888 888.

The 3-position locking toggle switch on the front panel marked Master/Norm/Slave selects the functional control of this module when it is connected in a standard ORTEC printing loop. It responds to a common preset signal for any switch position and also responds to local gate control and reset for any switch position. But with the switch set at Master, this module can also furnish gate control and reset to all the Slave modules in the system. When the switch is set at Slave, this module accepts gate control and reset from the system common lines. When the switch is set at Norm, it will neither furnish gate control and reset to the common lines nor accept these signals from the common lines. This operating selection permits the 772 to be used in combination with other printing modules with a very flexible control relationship.

The ORTEC 772H operates identically to the 772 but requires that the bin and power supply in which it is operated furnish $+6$ V dc as a power source. The ORTEC 401B/402H Bin and Power Supply is typical of the equipment required for this purpose.

2. SPECIFICATIONS

2.1. PERFORMANCE

Count Capacity 6 decades, for 000 000 through 999 999.

Counting Rates Negative input, 100 MHz; positive input, 20 MHz.

Discriminators Negative input trigger level fixed at -250 mV; positive input trigger level adjustment range 100 mV to 10 V; drift is <10 mV/ $^{\circ}$ C from 0° C to 50° C.

Pulse Pair Resolution Positive input, 50 nsec; negative input, 10 nsec; minimum duty cycle, 40% at either input at maximum counting rate.

Automatic Clear Generated when power is turned on initially or after a power failure.

2.2. INDICATORS

Display 6 direct-reading 7-segment LED digits with automatic blanking of insignificant zeros.

Overflow LED, illuminated from the first overflow until reset.

Gate LED, illuminated while unit is in the counting condition.

2.3. CONTROLS

Display Test Push-button switch illuminates all segments of each digit in the display when depressed; display reads 888 888.

Master/Norm/Slave 3-position locking toggle switch selects the counter's function when the module is connected in a data acquisition system. Master selects control over all slaves in the system by furnishing control signals through the common gate and reset lines. Norm isolates this module from system control through gate and reset lines. Slave accepts control from another module in the system, operating as a Master, that furnishes the system gate and reset signals.

Disc Single-turn screwdriver potentiometer sets the discrimination level for positive input signals; range 100 mV to 10 V.

Reset Push-button switch resets display and internal logic to an initial zero condition when pressed.

Count/Stop Toggle switch selects counting or noncounting condition of the unit manually.

2.4. CONNECTORS

Pos In Front and rear panel type BNC connectors accept positive unipolar or positive-leading bipolar signals to ± 25 V maximum. Input amplitude must exceed the adjusted discriminator level for a minimum of 20 nsec to be counted. $Z_{in} = 1$ k Ω to ground, dc-coupled.

Neg In Front panel type BNC connector accepts NIM-standard fast negative signals, 14 mA into 50 Ω , with 4-nsec minimum width. Input is protected to ± 25 V at 10% duty cycle and has a fixed -250 -mV discriminator level.

Gate Front and rear panel type BNC connectors accept NIM-standard slow positive logic signals to control the counter gate and the gate indicator. An open circuit or the application of a signal with $\geq +3$ -V amplitude enables the counting; $\leq +1.5$ V inhibits counting; input protected for 25 V maximum; 100-nsec minimum pulse width; driving source must be capable of sinking 0.5 mA of positive current.

Reset Rear panel type BNC connector accepts NIM-standard slow positive logic signal to reset the unit to an initial condition. A signal $\geq +3$ V resets; $\leq +1.5$ V does not reset; 25 V maximum; 100-nsec minimum pulse width. $Z_{in} = 2$ k Ω to ground, dc-coupled.

Oflow Rear panel type BNC connector furnishes NIM-standard positive logic output, +5 V for 2 μ sec, whenever the counter overflows from 999 999 to zero. Driving source impedance $\leq 10\Omega$, dc-coupled.

In/Out Rear panel Amphenol type 57-40140 connector includes four common data lines and all system logic for the standard ORTEC printing and/or counting system interconnections.

2.5. OPTION

772H Counter The 772H Counter is a complete unit, equal in performance to the 772; requires +6 V from Bin and Power Supply.

2.6. ELECTRICAL AND MECHANICAL

Power Required For the 772 Counter, +12 V, 80 mA; -12 V, 165 mA; +24 V, 75 mA; -24 V, 80 mA; 115 V ac (50 or 60 Hz), 50 mA. An internal power supply generates the +5-V source that is required by the integrated circuits; protected by a chassis-mounted 1-A 3AG fuse.

For the 772H Counter, +12 V, 80 mA; -12 V, 165 mA; +24 V, 75 mA; -24 V, 80 mA; +6 V, 550 mA. Must be operated in an ORTEC 401B/402H Bin and Power Supply or equivalent.

Dimensions Standard NIM single-width module (1.35 X 8.714 in.) per TID-20893.

3. INSTALLATION

3.1. GENERAL

The 772 Counter operates on input power that must be furnished from a Nuclear-standard Bin and Power Supply such as the ORTEC 401/402 Series. If any vacuum tube equipment is operated in the same rack with the 772, there must be sufficient cooling air circulating to prevent any localized heating of the integrated circuitry used throughout the 772. The temperature of equipment mounted in racks can easily exceed the maximum limits of 120°F (50°C) unless precautions are taken.

3.2. CONNECTION TO POWER

Turn off the Bin Power Supply when inserting or removing any modules. The ORTEC modules are designed so that it is not possible to overload the Power Supply with even a full complement of modules in the Bin. Since, however, this may not be true when the Bin contains modules other than those of ORTEC design, the Power Supply voltages should be checked after all modules have been inserted. The 401/402 has test points on the Power Supply control panel to permit monitoring the dc voltages easily.

The 772 requires 115 V ac as one of its power inputs. Some bins and power supplies, as well as jumper cables, may not be wired to include this power. In the event that the unit fails to operate in a new installation, check the bin and/or cable to determine whether the 115-V ac circuit is included.

The 772H version requires +6 V dc at 550 mA. It must be used with an ORTEC 401B/402H Bin and Power Supply or equivalent to satisfy this power requirement. No ac power is required for the 772H.

3.3. COUNTER INTERCONNECTION

When a counting system contains more than one 772 Counter or 773 Timer-Counter, the units are connected together as shown in Fig. 3.1. The In/Out connector on the rear panel of each module is used for this loop interconnection, and one cable is furnished with each of the printing modules to permit the loop to be formed. For nonprinting

2.7. ACCESSORY INCLUDED

Cable One ORTEC 772-C1 printing system control cable for interconnection with other ORTEC printing Counters, Timers, Digital Ratemeters, etc., in an ORTEC standard printing loop.

systems the order of interconnections is not important, but for printing systems the order of printing is 1 through n in sequence as shown in Fig. 3.1. Figure 3.2 shows how the 772-C1 cable provides the In and Out connections separately.

Normally, after the modules have been connected together in a system, one of the modules will be selected as the Master for the system and the remaining modules will all be Slaves. If an ORTEC 773 Timer-Counter is included in the system, it will usually be used to control the counting intervals with preset time, and the 773 will then logically be set as Master. All the 772 Counters in the system will be set for Slave.

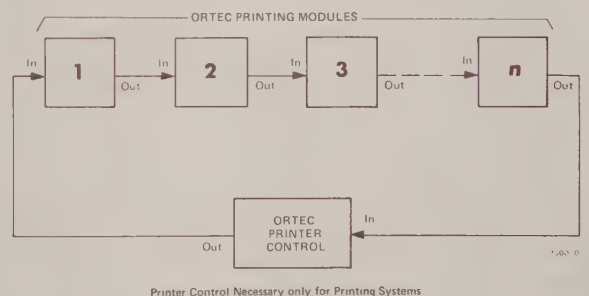


Fig. 3.1. Counter Interconnection for System Operation.

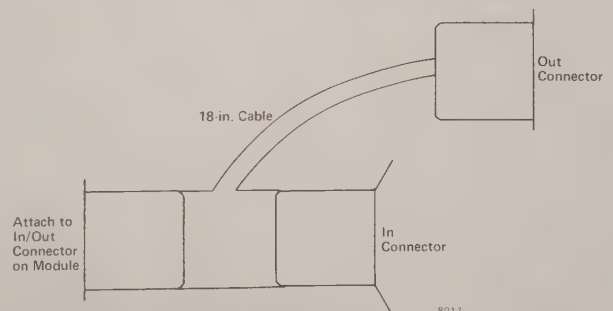


Fig. 3.2. Detail of 772-C1 Printing System Cable.

3.4. SIGNAL CONNECTIONS

Count Inputs The 772 accepts and counts either fast negative logic pulses or slow positive logic pulses. It can also accept positive analog pulses. Determine the type of input pulses that will be furnished and use the appropriate input.

Positive logic or analog signals can be connected to either the front or rear panel BNC connector. These two connectors are *not isolated* from each other; so signals from two sources should not be connected simultaneously to the two Pos In connectors. The input circuit in the 772 is dc-coupled to eliminate baseline shifts associated with changing counting rates. For signals with an average dc level greater than ± 25 V, external capacitive coupling must be provided by the user. For dc levels below ± 25 V, connection to the input can be made safely without damage to the 772. However, for the Counter to respond to any signals through the positive input circuit, there must be transitions of the signals at the adjusted Disc level. The adjustment range of the Disc is 0.1 to 10 V.

Negative logic signals must be furnished to the front panel Neg In connector. The input impedance in this circuit is 50Ω , dc-coupled, the standard impedance for which the fast negative logic pulse is defined. There is a fixed threshold level of -250 mV in this input circuit, and the input pulse needs to exceed this level for only 4 nsec to be counted.

The flexibility of the 772 makes it possible to count almost any positive input pulse wider than 20 nsec and greater than 100 mV or any negative input pulse wider than 4 nsec and greater than 250 mV. There are two important points to remember when supplying signals to the input: (1) The signal should not cross the threshold level more than one time. Signals with overshoot, ringing, etc., will be counted more than once if the discriminator level is raised to the level at which the perturbations occur. (2) Signals with slow rise and fall times should be as clean (noise-free) as possible because of the high gain and bandwidth of the 772 discriminator. As a slow signal approaches the threshold, a small spurious noise pulse can traverse the threshold and return, causing an extra count to be added to the contents of the scaler.

Gate Input The gate input signal can be connected to the 772 by either the front- or rear-panel-mounted BNC connector. As in the case of the count input connectors, no isolation is provided between the two inputs; therefore two signal sources are *not* to be connected simultaneously to the gate input. With no connection made to the gate input, the input voltage level is about +6 V, and the scaler gate will permit the unit to operate. To cut off the gate, the gate input must be pulled down to below +1.5 V but not below -5 V. To do this, the driving circuit must be capable of absorbing 0.5 mA from the gate input circuit. The gate circuit will permit counting when the Gate input is at +3 V or greater.

Reset Input The reset input signal can be connected to the 772 by means of the rear-panel-mounted BNC connector. To reset the scaler to zero, a positive signal of +3 V or greater originating from zero potential with a minimum width of 100 nsec should be used. The input impedance is approximately $2\text{ k}\Omega$ dc-coupled to ground. Negative signals will not perform any useful function at the reset input. The input circuitry will not be harmed as long as the input signal level does not exceed ± 25 V.

Overflow Output The overflow signal is available through a rear-panel-mounted Overflow BNC connector. A positive 5-V signal appears at the output each time the contents of the Counter change from 999 999 to 0. The output signal is 2 μ sec wide; Z_o is $<10\Omega$, dc-coupled.

In/Out System Connector Signals An adapter cable, 772-C1, is furnished with the 772 to attach to the In/Out connector and to make separate connectors available for the In and Out system interconnections. The signals on the In and Out connectors are listed in Table 3.1. The physical details of the 772-C1 cable are shown in Fig. 3.2; the system In connector is located on the opposite end of the connector block from the portion that attaches to the In/Out connector on the rear of the module, and the Out connector is on the remote end of the 18-in. multiwire cable that extends to the next module in the loop.

Pin 7 on the In/Out connector is the Previous Module Finished (PMF) signal from pin 7 of the In connector. Pin 13 on the In/Out connector is the This Module Finished (TMF) output to pin 7 of the Out connector. All the remaining pins are wired point-to-point between all three connectors in the cable.

Pins 12 and 14 carry an identification of 432 Off and This Module Printing signals respectively. These are used in other ORTEC printing modules if their count capacity is other than 6 decades; so they are wired through the loop but are not used in the 772.

Table 3.1

In Connector		Out Connector	
Pin	Description	Pin	Description
1	Data 1	1	Data 1
2	Data 2	2	Data 2
3	Data 4	3	Data 4
4	Data 8	4	Data 8
5	Print	5	Print
6	Print Advance	6	Print Advance
7	Previous Module Finished	7	This Module Finished
8	System Gate	8	System Gate
9	System Preset	9	System Preset
10	System Reset	10	System Reset
11	Ground	11	Ground
12	432 Off	12	432 Off
13	Spare	13	Spare
14	This Module Printing	14	This Module Printing

The functions of signals through the 14 pins of the In/Out connector are as follows:

Pins 1–4 — Data Lines Transfer the four bits of each digit from the assigned instrument to the Printout Control. Each instrument includes an isolated program control that drives these common lines only during its turn for printing.

Pin 5 — Print Prepares the instrument for data transfer during printing.

Pin 6 — Print Advance Advances the scanner in each instrument for readout of each of its digits during printing.

Pin 7 — Previous Module Finished Starts the actual data transfer from an instrument when it is its turn to be printed.

Pin 8 — System Gate Carries a gate-off signal to all instruments set for Slave operation in the system loop. The signal originates in a Master instrument, and this can be the 772. When the 772 is set for Slave, the system gate line will

affect that Counter. When the 772 is set for Master, a gate input will be imposed on the system gate line. A Counter that is set for Norm is isolated from the system gate line.

Pin 9 — System Preset Carries a preset signal to all instruments in the system loop. A preset condition gates off all modules in the system.

Pin 10 — System Reset Carries a reset signal to all instruments in the system loop except any that may be set for Norm. This signal originates in a Master module or in the 432A Printout Control.

Pin 11 — Ground Carries a common zero potential line to all modules in the system loop.

Pin 12 — 432 Off Has no effect on the 772.

Pin 13 — This Module Finished Signals the next instrument to start its data transfer.

Pin 14 — This Module Printing Has no effect on the 772.

4. OPERATING INSTRUCTIONS

4.1. FRONT PANEL CONTROLS AND INDICATORS

The following functions are indicated and controllable from the front panel:

Count/Stop Manually controls counting of the 772; Count position permits counting, and Stop position inhibits counting.

Gate Indicator An LED indicates the condition of the input gate. When it glows, the 772 is able to count input pulses. When it is dark, the 772 is inhibited from counting.

Reset A push-button switch resets the contents of the Counter to zero when it is depressed.

Disc A single-turn potentiometer selects the threshold level of the internal discriminator that is used for the positive input circuit only. The range of the control is +0.1 through 10 V. Normally, for counting logic signals, the level should be adjusted about half way between the lowest expected true-signal amplitude and the maximum false-signal amplitude. For use with linear signals assure that the signals have only one point of inflection, or some signals may cross the threshold more than one time and produce erroneous counts.

Master/Norm/Slave A 3-position locking toggle switch that controls the functional position of the 772 when it is used in an ORTEC printing system. This switch does not affect the operation of the Counter unless printer loop cables are connected to the rear panel. See Sections 4.4 and 4.5 for further information.

Overflow Indicator An LED lights if the counter capacity of 999 999 counts is exceeded, and remains lighted until the unit is reset.

Display Test A push-button switch permits a quick check of the digital display. When it is pressed, all seven segments of each of the six digits will be lighted, regardless of the counter contents, and the display will read all "eights."

Digital Display Six 7-segment characters with logically selected blanking for each segment display the Counter contents at all times except during printing intervals and the display test interval. Each digit is displayed during printing while it is being furnished to the printer.

4.2. INITIAL OPERATION OF COUNTER

1. Install the 772 into a 401/402 series Bin and Power Supply or equivalent and turn on the power.

2. Press Reset. The display should now indicate that the contents of the Counter are zero.
3. Press Display Test. The display should read 888 888, and should return to 0 when the switch is released.
4. Set the Count/Stop switch at Count and the Gate indicator should light. Set the switch at Stop and the light should go out.
5. Connect a signal to the Input connector on either the front or rear panel.
6. Set the Count/Stop switch at Count.
7. Turn the Disc control counterclockwise until the 772 starts to count.
8. Ground the Gate input and observe that counting stops and the indicator LED is not lighted. Remove the ground and restore the counting condition.
9. Set the Count/Stop switch at Stop, and counting should stop and the indicator should again not be lighted.

4.3. COUNTING SETUP WITH ONE COUNTER

Proceed as outlined in Section 4.2 but omit those steps used in "testing" the instrument. Be sure that the input signals do not exceed the ± 25 -V maximum limits.

4.4. COUNTING SETUP WITH MULTIPLE COUNTER-TIMER MODULES

Preferred Setup In a multiple-counter setup each Counter should be inserted into the Bin and Power Supply and connected together with the printer loop cables as shown in Fig. 3.1 (without the Printer Control). For nonprinting systems the sequential arrangement of the cables is not important.

With the units properly connected together the individual count and gate signal connections are made to the respective Counters. When all units are installed, testing of individual Counters can be performed by operating each unit in either its Master or Norm mode. This frees the unit under test from all other units in the system except for a preset condition. If the gate indicator does not light or if the Counter does not accumulate counts during this phase, check to see whether a Timer in the system has reached preset time. Any module that reaches preset will stop all modules from counting. This can be eliminated during the setup phase by resetting the Timer and turning it off.

After the individual Counters have been set up and tested for proper operation, the Master/Norm/Slave switches can be set as desired. Normally in a counting system one Counter or Timer will be selected as the Master and all the others will be set for Slave. With this arrangement the entire

counting system can be controlled for reset and gating from the Master. The Count/Stop switch on the Master or its gate input could be used to start and stop accumulation in all the Counters and Timers, and the Reset push button on the Master would reset all of the system. In addition to the overall system gating control from the Master, if any gate input signals are furnished to any of the Slave units or if any have a reset signal or manual command, each such signal will affect only the Slave unit in which it originates. It is important to remember that a Counter selected to operate in the Norm mode cannot be started or stopped by a Master unit, but will respond only to a preset signal in the system in addition to any signals that originate in that particular module.

Alternate Connections for One or Two Counters with a Timer The module interconnection scheme shown in Fig. 3.1 is the preferred manner of connecting more than one Counter or Timer into a data system because of the flexibility it offers and the simplicity of interconnections. There is, however, an alternate connection for a simple setup involving a 773 Timer-Counter and one or two 772 Counters without using the printer loop cables. A coaxial cable connected from the rear panel Intval (Interval) connector of the 773 to the Gate input connector on each Counter will allow the Count/Stop switch on the Timer to start and stop counting and timing together, providing all Counters are set for the Count condition. When the 773 reaches preset time, the Counters stop counting.

If in the setup described in the previous paragraph the 773 Timer-Counter had been operated as a Counter, the 773 data would have represented the number of counts above its threshold per N (preset condition) counts from another source that was being counted in the 772. The ratio of two counting rates can be determined in this manner.

4.5. PRINTING SYSTEMS

The 772 Counter is designed to operate as part of an automatic data acquisition system, from which all data can be printed by either an ORTEC 777 Line Printer or, with an ORTEC 432A, by an ORTEC 222 (modified Teletype). The 772 Counter is operated the same for either of these two serial printing accessories.

The 772, upon command, provides the data stored in its counting register to the 777 Line Printer or the 432A Printout Control and the 222 Teletype in a serial-by-character format. The data are fed out in six groups (characters), from the most significant digit to the least significant digit, at a rate determined by the printout accessory. Each group or character is composed of four bits of information in a 1-2-4-8 BCD code, with logical one being about +6 V and logical zero about 0 V. Figure 4.1 shows the sequence of events for a single Counter that contains the accumulated count level 705 849. As a note of explanation, the Print Command signal originates in the 432A or 777. It can be initiated manually, be triggered externally, or be

initiated automatically by a module in the system reaching a preset condition. The Start Data Transfer is supplied from the 432A or 777 to Counter 1 (Fig. 3.1), from Counter 1 to Counter 2, from Counter 2 to Counter 3, etc. In other words, as each module finishes transferring its data, it sends a signal to the following module to allow its data transfer to begin. In the system the Start Data Transfer signal is called Previous Module Finished on the In connectors of the cables and This Module Finished on the Out connectors.

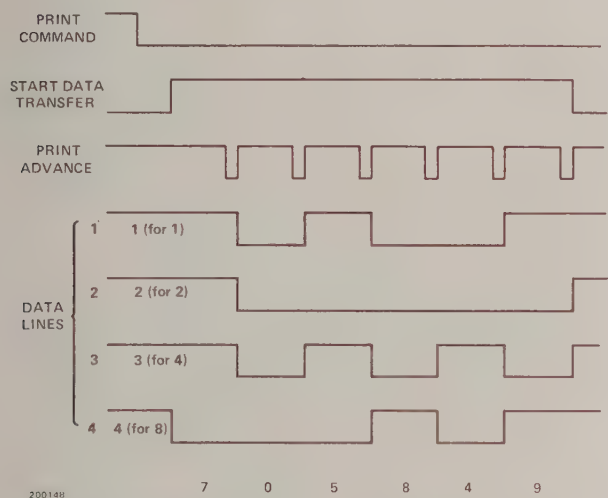


Fig. 4.1. Signal Sequence for Transferring Data for 705 849 from a Printing Scaler to the Printout Control.

The following sequence of events illustrates how a multiple-counter printing system with a 432A Printout Control and a Teletype operates:

1. A Print Command is generated manually, by a trigger, or by a preset condition.
2. All Counters and Timers in the system stop accumulating and remain static for 1 or 2 sec.
3. All displays are blank except the most significant character in the display of Counter 1; this digit is lighted until the digit has been printed by the output device.
4. Each of the remaining five digits in Counter 1 is printed in succession, and, as each digit is being printed, it is also illuminated in the display of the Counter.

5. A space is generated in the printed format after the six digits that represent the data in Counter 1.
6. The six digits for Counter 2 are printed in succession.
7. A space is formed as in step 5.
8. This sequence repeats until the last Counter has finished printing. Carriage return and line feed replace the space function at appropriate times in the program.

9. After the last set of data has been printed, one of two basic modes can be selected at the 432A: (a) the system will remain in a static or noncounting mode until a new cycle is started, and the display will be turned on, or (b) a system reset is generated and data accumulation will be repeated.

The program for use with the ORTEC 777 Line Printer operates as follows:

1. A Print Command is generated manually, by a trigger, or by a preset condition.
2. The 777 prints the entire data word. Since the 777 capacity is 7 digits per word, the first digit will automatically be a zero when any 6-digit counter or timer is being printed out.
3. The 777 has a line feed and advances the paper so that the next data word will appear on the next line.
4. The six digits for Counter 2 are transferred to the 777.
5. The 777 prints the second data word and then has a line feed.
6. This sequence repeats until the last counter has finished printing. A double line feed in the 777 indicates completion of the data set.
7. After the last set of data has been printed, one of two basic modes can be selected by the 777: (a) the system will remain static or noncounting until a new cycle is started, and the displays in the modules will be turned on, or (b) a system reset is generated and data accumulation will be repeated.

5. CIRCUIT DESCRIPTION

5.1. GENERAL

Figure 5.1 is a block diagram that shows the relations between the circuit components in the 772 Counter. The complete schematic of the 772 is shown in 772-0101-S1 at the back of the manual.

As shown in Fig. 5.1, input pulses can be furnished through either the positive or the negative input circuit and then be subjected to gating before they are counted. Reset of the counting register can originate locally or from the system reset line. The control logic also includes routing to and from the system lines according to the selection that is made with the Master/Norm/Slave switch.

The 24 data lines, for the six 4-bit word groups from the counting register, are gated, one word at a time, to the four common data lines. These data lines lead into a decoder for the display and to the output for the printing loop. An internal scanner gates the four bits for a digit onto the four common lines and also selects the proper location in the display for that digit.

During nonprinting intervals the scanner is driven by an internal oscillator that operates at about 1 kHz and continually recycles the scan through the six digits. During printing intervals the internal oscillator is turned off and the scan is advanced at the rate of the printing accessory.

5.2. POSITIVE INPUT CIRCUIT

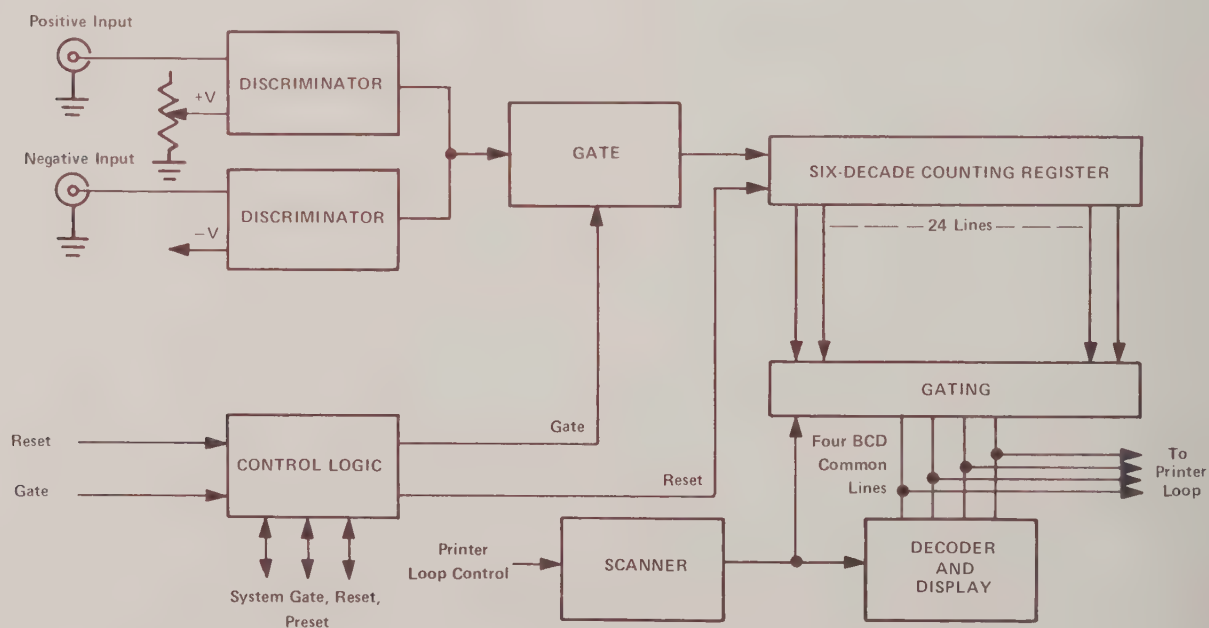
Positive input pulses can be accepted through either the Pos In connector on the front panel or the Input connector on the rear panel. They are dc-coupled into IC 32, a differential comparator. A dc level is applied to the negative input of IC 32 from the front panel Disc control, R66. If the input pulse amplitude exceeds the discriminator bias, a pulse is generated that can pass through Q16 and IC 31-3 to gate IC 31-15. If the gate is enabled, the pulse is furnished to the clock input of IC 29 for one count in the counting register.

5.3. NEGATIVE INPUT CIRCUIT

Negative input pulses can be accepted through the Neg In connector on the front panel. An input pulse that exceeds the fixed bias level at -250 mV passes through Q15 to gate IC 31-14. If the gate is enabled, the pulse is furnished to the clock input of IC 29 for one count in the counting register.

5.4. GATING

Local gating is controlled by either the toggle switch S3 or by a signal through either the front or rear panel Gate BNC connector.



8018

Fig. 5.1. Block Diagram of ORTEC 772 Counter.

With switch S3 set at stop, as shown in the schematic, IC 26-3 is held low. The signal passes through IC 25-8, IC 24-2, and IC 26-8 to make pin 8 of IC 26 high. The Gate LED will not light because there is no voltage difference across it. This signal then passes through Q18 and Q17 and furnishes a high at both pins 11 and 12 of IC 31, so neither input circuit gate is enabled. When switch S3 is set at count, the status of the circuit is inverted to light the LED and to enable both input gates.

With switch S3 at count the local gate control can still be affected by an input through either Gate BNC connector. When the input is shorted to ground (or drawn down to $\leq +1.5$ V), this is coupled through Q19 to force IC 28-8 high; when IC 28-8 is high, the LED is not lighted and both gates are disabled. When the input circuit is either open or has a signal $\geq +3$ V, IC 28-8 is low and the LED lights and the input gates are enabled.

5.5. COUNTING REGISTER

The counting register includes IC's 29, 30, and 14 through 18. IC 29 and IC 30 provide four D flip-flops that are connected as a 1-2-4-8 BCD decade. These packages feature fast response and permit counting the fast negative input pulses at a rate of up to 100 MHz. IC 13 is a logic level translator for the four bits of the least significant digit. IC 14 through IC 18 are decade packages that complete the ripple counter for the second through sixth digits.

The overflow output from IC 18 is coupled through C17 to generate an output pulse through the Overflow BNC connector on the rear panel unless the signal is false, caused by a reset rather than by a count accumulation. The first overflow after a reset will also set flip-flop IC 19-3 and 16 to light LED2 until the next reset.

The four bits for each of the six digits are furnished through gates to the four common data lines. Each of the six digits is furnished through a gate that is enabled by a signal from an internal scanner, and the gates involved are IC's 3 through 8. The scanner signals are identified as Z1 through Z6 respectively for the most- to least-significant digit. For example, when the Z1 signal is present, the four bits from IC 18 are transferred to the four common lines through the four gates in IC 8.

5.6. SCANNER

The internal scanner generates the Z1 through Z6 signals in sequence and gates the most significant digit onto the common lines first, followed by each less significant digit in order. When no print signal is furnished from the printer loop (nonprinting condition), an internal oscillator advances the scanner. When a print signal is present (through a printing interval), the scanner counts print advance signals between a PMF input signal and a TMF output signal; so it scans through the available digits only one time during the printing cycle.

The internal oscillator uses IC 22-2 and -4 to generate an output signal at about 1 kHz. The output feeds through IC 21-3, unless a print signal is present, then through IC 21-11 to the clock input of divide-by-6 counter IC 11. The 1-, 2-, and 4-bit outputs of IC 11 are furnished to decoder IC 10, and the 8-bit input to IC 10 is grounded (= zero). When IC 10 has all four input bits at zero, it identifies 0 at the output and generates a Z1 signal at IC 9-2. The next oscillator pulse changes the count in IC 11 and is decoded in IC 10 to generate Z2 at IC 9-4. This continues until each signal, Z1 through Z6, has been generated in turn and an oscillator pulse advances the Counter out of the Z6 condition to Z1 again.

Control of the scanner during a printing cycle is discussed in Section 5.8.

5.7. DECODER AND DISPLAY

The four bits that are present on the common lines at any time identify one of the six digits. This combination is decoded in IC 1 to furnish the correct configuration of blanking and illumination to the seven LED segments at the anodes of each of the six digits in the display, LED3. The scanner signal will have selected which of the six digits is to be gated onto the common lines and the same scanner signal completes a cathode path for the proper digit in the display. For example, when Z6 is present, the signal at pin 6 of LED3 selects the least significant digit in the display and its illuminated segments will identify the character that is gated through IC 3 onto the four common lines.

For reference, the seven segments are identified *a* through *g*. Viewed from the front of the display, segment *a* is across the top; *b* is the upper half of the right side; *c* is bottom right; *d* is across the bottom; *e* is the lower left; *f* is the upper left; and *g* is across the center. Any digit, 0 through 9, can be illuminated by selectively blanking the segments. When switch S1 is pressed, IC 1 provides no blanking for any segment and the display should illuminate all segments for a reading of 888 888.

IC 19-11 and -8 provide the control to completely blank all insignificant zeros in the display. At Z1 time, for the most significant digit, IC 1 receives a signal from IC 19-8 to blank all segments if a zero is present. Internal logic in IC 1 resets the blanking control through IC 19-11 when it receives an identification of any digit other than zero through the four common input lines or from switch S1. So until there is a digit other than 0, nothing will be shown in the scan of the display. When the scan reaches Z6, for the least significant digit, the signal at pin 9 of IC 19-8 removes the blanking control to IC 1 if it had not been removed before that time, and the least significant digit is displayed whether it is zero or not.

5.8. PRINTING CIRCUIT

A printing loop is formed by cabling the printing modules to either an ORTEC 777 Line Printer or (through an

ORTEC 432A Printer Control) an ORTEC 222 Teletype in a circuit as shown in Fig. 3.1. In normal operation the Counters and Timers in the system can count until a system preset signal occurs; then all modules stop counting and the accumulated data are transferred to the Printer, one module at a time. At system preset all modules stop and the 777 or 432A generates a print output.

In the 772 the system preset is accepted through Q8 to turn off the input gate through IC's 24-4, 24-6, 25-8, 24-2, and 26-8 and Q18 and Q17. This prevents any change in the counting register. The print signal is accepted through Q4 to inhibit oscillator gate IC 21-3, to reset the scanner to Z1 through IC 22-12 and IC 21-6 to IC 22-8, and to clamp all four gates of IC 2 to provide a "code 15" input to IC 1 and to thus blank the display. The module then waits until its turn in the system to be printed out. This is signaled by a PMF (Previous Module Finished) signal from the printer loop that originates in the control module if the 772 is Counter 1 in the configuration of Fig. 3.1 or is the TMF (This Module Finished) output from the previous module for any of the other positions in the loop.

At PMF the signal releases the reset of IC 20, releases the reset latch at IC 22-8 through IC's 21-8 and -6, releases the blanking clamp to IC 2, and enables gates IC 12 to transfer the data from the common lines in the 772 to the system common lines and from there through the control module to the Printer. Since Z1 has been preselected, the most significant digit is transferred to the Printer and is also shown in the display. At print advance, when the digit has been accepted by the Printer, the signal through Q5 and IC 21-11 advances the scanner, etc. This continues until the trailing edge of Z6 clocks IC 20 to set to isolate the 772 from the system printing lines, to blank the display, and to furnish a TMF output signal to the system loop. When the entire system has been printed out, the control module determines the next sequence and will remove preset, generate system reset, or whatever is appropriate to the program that has been selected.

5.9. MASTER/NORM/SLAVE CIRCUITS

When switch S2 is set at Master, the internal reset and gate signals in the 772 can be furnished out to the system reset and system gate lines for control of any other modules that are set for Slave operation. IC 27-11 permits the signals at IC 27-8 to be furnished out to the system gate line through Q11. IC 23-8 is inhibited from passing any signals that may be furnished from the system gate line through Q10 and IC 24-8.

With switch S2 set at Master, IC 23-6 permits any reset signals that are furnished from the internal circuit through IC 26-11 to pass through IC 24-10 and Q6 to drive the system reset line.

If switch S2 is set at Slave, the above conditions are reversed: IC 27-11 is low and prevents the internal gate signal from reaching the system gate line, while IC 23-8 permits the system gate line signal to be accepted into the 772. Gate IC 23-6 inhibits the local reset signals from reaching the system reset line, but a system reset signal can be accepted through Q7, IC 24-12, and IC 23-12 to generate a local reset.

If switch S2 is set at Norm, the system gate and system reset lines are isolated from the internal functions in the 772. This is obtained by inhibit to IC 23-6, IC 23-12, IC 23-8, and IC 27-11.

5.10. LOCAL RESET

Local reset is generated at IC 25-6 if any of its inputs goes low. The inputs originate with switch S4, power-up reset through Q9, from the rear panel Reset connector through Q12 and IC 28-12, or from system reset through Q7, IC 24-12, and IC 23-12. When IC 25-6 goes high, all six decades of the counting register are reset to zero; if in this process the 8 bit of IC 18 were reset, an Oflow output would be generated if not inhibited by IC 28-4.

Local reset is inverted by IC 28-10 to reset flip-flop IC 19-3 and -6 if it had been set by an overflow, and LED1 will then be turned off. The inverted signal is also returned to IC 25-8 to turn off the gate and its indicator during reset.

5.11. POWER SUPPLIES

There are two internal power supplies in the 772 Counter. One generates -5.2 V, required for operation of the ECL integrated circuit packages, and the other generates $+5$ V, required for the operation of all other integrated circuits.

Transformer T1 furnishes secondary voltage that is full-wave rectified and filtered on the power supply chassis. Q22, Q23, and Q24 form a regulator for the $+5$ -V output, and fuse F1 protects the power supply from overload. The fuse is type 3AG with a rating of 1 A, fast acting.

The 772H version does not contain this portion of the $+5$ -V power supply, consisting of the components on the power supply chassis (775-0100-1). It obtains its $+5$ -V power from the $+6$ -V source in the ORTEC 401B/402H Bin and Power Supply. In this version the collector of Q24 is connected directly to pin 10 of the rear panel module connector.

The -5.2 -V source, in both the 772 and 772H versions, is obtained from the -12 -V input from the Bin and Power Supply. Q20 and Q21 form a regulator for this supply. The three ECL-type packages that require this supply are IC's 29, 30, and 31.

6. MAINTENANCE

6.1. GENERAL

The basic performance of the 772 Counter can be tested by following the procedure outlined in Section 4.2. This will not check the unit to its published specifications.

If the unit fails to respond properly during testing, use the information in Section 5 to determine the fault. Schematic 772-0101-S1 is included at the back of this manual.

6.2. FUSE REPLACEMENT

If the front panel display and indicators will not light, remove the module from the bin and take off the left side

panel for access to the inside of its rear panel. Inspect fuse F1, mounted in a fuseholder on the rear panel. This fuse protects the +5-V power source, and the indicators cannot be lit unless this power is present. Replace the fuse with a 1-A fast-acting type 3AG fuse only.

6.3. FACTORY REPAIR

The 772 Counter may be returned to ORTEC for repair service at nominal cost at any time. Our standard procedure requires that each repaired instrument receive the same extensive quality control tests that a new instrument receives. Please contact our Customer Service Department, (615) 482-4411, before returning the instrument.

APPENDIX

REPLACEABLE PARTS

ORDERING INFORMATION

The Replaceable Parts List shown below contains information needed for ordering spare and/or replacement parts. Each listing indicates the reference designator number, the part number, a description of the component, and the part manufacturer and manufacturer's part number.

All inquiries concerning spare and/or replacement parts and all orders for same should include the model and serial numbers of the instruments involved and should be addressed to the Customer Service Department at 100 Midland Road, Oak Ridge, Tennessee 37830. The Manager of Customer Services can be reached by telephone at

(615) 482-4411. The minimum order for spare and/or replacement parts is \$25.00.

ORDERING INFORMATION
FOR PARTS NOT LISTED

In order to facilitate the ordering of a part not listed below, the following information should be submitted to the Customer Service Department:

1. the instrument model number,
2. the instrument serial number,
3. a description of the part,
4. information as to the function and location of the part.

Replaceable Parts List

REFERENCE DESIGNATOR	ORTEC PART NO	DESCRIPTION	MFR.	MFR PART NO.
772-0100	5004 46237			
30	9097 41339	Connector, BNC, CN1-7	95712	DGE #UG1094/U
32	9097 41315	Connector, 14-Pin, CN8	02660	ABE #57-40140
LED1	9103 63798	LED, Indicator W/Mount	72619	DIL #521-9166
LED2	9103 63798	LED, Indicator W/Mount	72619	DIL #521-9166
R55	9015 40219	470 Ω 1/4W 5% C	01121	ABC CB
R66	9047 43583	1 K 20-T TPT.	02111	SPT #43Y-R1K
R68	9015 40219	470 Ω 1/4W 5% C	01121	ABC CB
R74	9015 40219	470 Ω 1/4W 5% C	01121	ABC CB
S1	9094 41293	Switch, P-B, SPDT, Red	82389	SWC #953
S2	9094 44464	Switch, Toggle, DPTT	95146	AEP #MST-206-PA
		Locking (On-on-On)		
S3	9094 41277	Switch, Toggle, SPDT	95146	AEP #MST-105D
S4	9094 41293	Switch, P-B, SPDT, Red	82389	SWC #953

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
772-0200	5007 46238			
C1	9059 40889	200 pf 2% 500V D.M.	84171	ARC #DM15-201G
C2	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C3	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C4	9059 40889	200 pf 2% 500V D.M.	84171	ARC #DM15-201G
C5	9059 40889	200 pf 2% 500V D.M.	84171	ARC #DM15-201G
C6	9059 40889	200 pf 2% 500V D.M.	84171	ARC #DM15-201G
C7	9059 40892	470 pf 5% 500V D.M.	84171	ARC #DM15-471J
C8	9061 40917	0.1 uf 10% 200V Myl.	80183	SPR #192P10492
C9	9055 40855	0.01 uf 20% 50V Disc	80183	SPR #C023K101F103M
C10	9065 49541	27 uf 15V Tan.	12954	DCK #DCK27GSB15M
C11	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C12	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C13	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C14	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C15	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C16	9065 40942	1 uf 20% 35V Tan.	80183	SPR #150D105X0035A2
C17	9059 40886	100 pf 2% 500V D.M.	84171	ARC #DM15-101G
C18	9055 40855	0.01 uf 20% 50V Disc	80183	SPR #C023K101F103M
C19	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C20	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C21	9065 40948	6.8 uf 20% 35V Tan.	80183	SPR #150D685X0035B2
C22	9065 40948	6.8 uf 20% 35V Tan.	80183	SPR #150D685X0035B2
C23	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C24	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C25	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C26	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C27	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C28	9055 40855	0.01 uf 20% 50V Disc.	80183	SPR #C023K101F103M
C29	9065 49563	220 uf 20% 10V Tan.	31433	KMT #T110D227M010AS
D1	9080 41098	Diode - 1N270	24446	GEC
D2	9080 41125	Diode - 1N4009	14433	ITT
D3	9080 41125	Diode - 1N4009	14433	ITT
D4	9080 41125	Diode - 1N4009	14433	ITT
D5	9080 41125	Diode - 1N4009	14433	ITT
F1	9101 41362	Fuse, Std., 1 Amp.	75915	LIT #3AG
IC1	9079 49522	IC - SN7448N - Tested	27014	NSC
IC2	9079 44073	IC - SN7400N	27014	NSC
IC3	9079 44083	IC - SN7403N	27014	NSC
IC4	9079 44083	IC - SN7403N	27014	NSC
IC5	9079 44083	IC - SN7403N	27014	NSC
IC6	9079 44083	IC - SN7403N	27014	NSC
IC7	9079 44083	IC - SN7403N	27014	NSC
IC8	9079 44083	IC - SN7403N	27014	NSC

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
772-0200	5007 46238			
Cont'd.				
IC9	9079 44079	IC - SN7404N	27014	NSC
IC10	9079 63786	IC - SN74145N	01295	TII
IC11	9079 63768	IC - SN7492N	27014	NSC
IC12	9079 44057	IC - N8881A	18324	SGT
IC13	9079 60456	IC - MC1039L	80211	MOT
IC14	9079 44072	IC - SN7490N	27014	NSC
IC15	9079 65468	IC - SN74L90N	01295	TII
IC16	9079 65468	IC - SN74L90N	01295	TII
IC17	9079 65468	IC - SN74L90N	01295	TII
IC18	9079 65468	IC - SN74L90N	01295	TII
IC19	9079 44073	IC - SN7400N	27014	NSC
IC20	9079 49504	IC - SN7474N	27014	NSC
IC21	9079 44073	IC - SN7400N	27014	NSC
IC22	9079 44079	IC - SN7404N	27014	NSC
IC23	9079 44081	IC - SN7410N	27014	NSC
IC24	9079 44079	IC - SN7404N	27014	NSC
IC25	9079 49497	IC - SN7440N	27014	NSC
IC26	9079 44073	IC - SN7400N	27014	NSC
IC27	9079 44083	IC - SN7403N	27014	NSC
IC28	9079 44082	IC - SN4705N	27014	NSC
IC29	9079 60464	IC - MC10131	80211	MOT
IC30	9079 60464	IC - MC10131	80211	MOT
IC31	9079 49530	IC - MC10102	80211	MOT
IC32	9079 41815	IC - 7410	13715	FSC #U5B771039X
Q1	9078 43655	Transistor - MPS6531	80211	MOT
Q2	9078 43650	Transistor - MPS6534	80211	MOT
Q3	9078 43655	Transistor - MPS6531	80211	MOT
Q4	9078 43655	Transistor - MPS6531	80211	MOT
Q5	9078 43655	Transistor - MPS6531	80211	MOT
Q6	9078 43655	Transistor - MPS6531	80211	MOT
Q7	9078 43655	Transistor - MPS6531	80211	MOT
Q8	9078 43655	Transistor - MPS6531	80211	MOT
Q9	9078 43655	Transistor - MPS6531	80211	MOT
Q10	9078 43655	Transistor - MPS6531	80211	MOT
Q11	9078 43655	Transistor - MPS6531	80211	MOT
Q12	9078 43655	Transistor - MPS6531	80211	MOT
Q13	9078 43651	Transistor - MPS3646	80211	MOT
Q14	9078 43655	Transistor - MPS6531	80211	MOT
Q15	9078 43653	Transistor - MPS6507	80211	MOT
Q16	9078 41078	Transistor - 2N3640	13715	FSC
Q17	9078 43650	Transistor - MPS6534	80211	MOT
Q18	9078 43650	Transistor - MPS6534	80211	MOT
Q19	9078 43655	Transistor - MPS6531	80211	MOT
Q20	9078 41083	Transistor - 2N3643	13715	FSC
Q21	9078 47887	Transistor - MJE370	80211	MOT
Q22	9078 41083	Transistor - 2N3643	13715	FSC
Q23	9078 41070	Transistor - 2N3053	86684	RCA

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR.	MFR. PART NO.
772-0200	5007 46238			
Cont'd.				
Q24	9078 43682	Transistor - MJE3055	80211	MOT
R1	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R2	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R3	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R4	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R5	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R6	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R7	9015 40233	2.4 K 1/4W 5% C	01121	ABC CB
R8	9015 40224	820 Ω 1/4W 5% C	01121	ABC CB
R9	9015 40224	820 Ω 1/4W 5% C	01121	ABC CB
R10	9015 40253	33 K 1/4W 5% C	01121	ABC CB
R11	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R12	9015 40259	6.2 K 1/4W 5% C	01121	ABC CB
R13	9015 40253	33 K 1/4W 5% C	01121	ABC CB
R14	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R15	9015 40246	12 K 1/4W 5% C	01121	ABC CB
R16	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R17	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R18	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R19	9015 40277	3.6 K 1/4W 5% C	01121	ABC CB
R20	9015 40242	7.5 K 1/4W 5% C	01121	ABC CB
R21	9015 40209	100 Ω 1/4W 5% C	01121	ABC CB
R22	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R23	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R24	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R25	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R26	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R27	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R28	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R29	9015 40231	2 K 1/4W 5% C	01121	ABC CB
R30	9015 40231	2 K 1/4W 5% C	01121	ABC CB
R31	9015 40231	2 K 1/4W 5% C	01121	ABC CB
R32	9015 40231	2 K 1/4W 5% C	01121	ABC CB
R33	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R34	9015 40250	20 K 1/4W 5% C	01121	ABC CB
R35	9015 40250	20 K 1/4W 5% C	01121	ABC CB
R36	9015 40250	20 K 1/4W 5% C	01121	ABC CB
R37	9015 40237	3.9 K 1/4W 5% C	01121	ABC CB
R38	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R39	9015 40212	200 Ω 1/4W 5% C	01121	ABC CB
R40	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R41	9015 40202	10 Ω 1/4W 5% C	01121	ABC CB
R42	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R43	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R44	9015 40245	10 K 1/4W 5% C	01121	ABC CB
R45	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R46	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R47	9015 40235	3 K 1/4W 5% C	01121	ABC CB
R48	9015 40235	3 K 1/4W 5% C	01121	ABC CB

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO	DESCRIPTION				MFR	MFR PART NO	
772-0200	5007 46238							
Cont'd.								
R49	9015 40226	1 K	1/4W	5%	C	01121	ABC	CB
R50	9015 40226	1 K	1/4W	5%	C	01121	ABC	CB
R51	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R52	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R53	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R54	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R56	9027 40510	511 Ω	1/8W	1%	MF	24546	CGW	C-4
R57	9027 40510	511 Ω	1/8W	1%	MF	24546	CGW	C-4
R58	9015 40209	100 Ω	1/4W	5%	C	01121	ABC	CB
R59	9015 40287	1.3 K	1/4W	5%	C	01121	ABC	CB
R60	9027 40504	348 Ω	1/8W	1%	MF	24546	CGW	C-4
R61	9015 40221	620 Ω	1/4W	5%	C	01121	ABC	CB
R62	9015 40232	2.2 K	1/4W	5%	C	01121	ABC	CB
R63	9015 40245	10 K	1/4W	5%	C	01121	ABC	CB
R64	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R65	9027 40517	1.47 K	1/8W	1%	MF	24546	CGW	C-4
R67	9027 40481	10 Ω	1/8W	1%	MF	24546	CGW	C-4
R69	9015 40271	51 Ω	1/4W	5%	C	01121	ABC	CB
R70	9015 40232	2.2 K	1/4W	5%	C	01121	ABC	CB
R71	9015 40228	1.2 K	1/4W	5%	C	01121	ABC	CB
R72	9015 40232	2.2 K	1/4W	5%	C	01121	ABC	CB
R73	9015 40231	2 K	1/4W	5%	C	01121	ABC	CB
R75	9027 40594	57.6 K	1/8W	1%	MF	24546	CGW	C-4
R76	9027 40598	34.8 K	1/8W	1%	MF	24546	CGW	C-4
R77	9027 40547	12.1 K	1/8W	1%	MF	24546	CGW	C-4
R78	9015 40235	3 K	1/4W	5%	C	01121	ABC	CB
R79	9015 40212	200 Ω	1/4W	5%	C	01121	ABC	CB
R80	9015 40231	2 K	1/4W	5%	C	01121	ABC	CB
R81	9015 40278	11 K	1/4W	5%	C	01121	ABC	CB
R82	9015 40229	1.5 K	1/4W	5%	C	01121	ABC	CB
R83	9015 40216	330 Ω	1/4W	5%	C	01121	ABC	CB
R84	9015 40231	2 K	1/4W	5%	C	01121	ABC	CB
R85	9015 40238	4.7 K	1/4W	5%	C	01121	ABC	CB
R86	9015 40209	100 Ω	1/4W	5%	C	01121	ABC	CB
R87	9015 40219	470 Ω	1/4W	5%	C	01121	ABC	CB
R88	9015 40253	33 K	1/4W	5%	C	01121	ABC	CB
R89	9015 40218	390 Ω	1/4W	5%	C	01121	ABC	CB
R90	9015 40229	1.5 K	1/4W	5%	C	01121	ABC	CB
R91	9015 40226	1 K	1/4W	5%	C	01121	ABC	CB
R92	9015 40246	12 K	1/4W	5%	C	01121	ABC	CB
R93	9015 40238	4.7 K	1/4W	5%	C	01121	ABC	CB
R94	9015 40237	3.9 K	1/4W	5%	C	01121	ABC	CB
R95	9015 40226	1 K	1/4W	5%	C	01121	ABC	CB
R96	9015 40253	33 K	1/4W	5%	C	01121	ABC	CB
R97	9015 40238	4.7 K	1/4W	5%	C	01121	ABC	CB
R98	9015 40238	4.7 K	1/4W	5%	C	01121	ABC	CB

Replaceable Parts List (continued)

REFERENCE DESIGNATOR	ORTEC PART NO.	DESCRIPTION	MFR	MFR. PART NO.
772-0200	5007 46238			
Cont'd.				
R99	9015 40229	1.5 K 1/4W 5% C	01121	ABC CB
R100	9015 40218	390 Ω 1/4W 5% C	01121	ABC CB
R101	9015 40253	33 K 1/4W 5% C	01121	ABC CB
R102	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R103	9015 40246	12 K 1/4W 5% C	01121	ABC CB
R104	9015 40232	2.2 K 1/4W 5% C	01121	ABC CB
R105	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R106	9015 40246	12 K 1/4W 5% C	01121	ABC CB
R107	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
R108	9015 40253	33 K 1/4W 5% C	01121	ABC CB
R109	9015 40226	1 K 1/4W 5% C	01121	ABC CB
R110	9015 40259	6.2 K 1/4W 5% C	01121	ABC CB
R111	9015 40209	100 Ω 1/4W 5% C	01121	ABC CB
R112	9015 40227	1.1 K 1/4W 5% C	01121	ABC CB
R113	9027 40520	1.78 K 1/8W 1% MF	24546	CGW C-4
R114	9027 43710	5.23 K 1/8W 1% MF	24546	CGW C-4
R115	9027 40522	2 K 1/8W 1% MF	24546	CGW C-4
R116	9027 40528	2.87 K 1/8W 1% MF	24546	CGW C-4
R117	9015 40235	3 K 1/4W 5% C	01121	ABC CB
R118	9015 40238	4.7 K 1/4W 5% C	01121	ABC CB
2	9101 41754	Fuse Clip, PC Type	75915	LIT #B-102068
772-C1	6011 46236			
2	9097 41727	Connector, 14-Pin	02660	ABE #57-30140
3	9097 65316	Connector, 14-Pin (Modified Fm #41727)	ORTEC	ABE #57-30140 (772-0107)
4	9097 65314	Connector, 14-Pin	02660	ABE #57-60140
5	9097 65315	Connector, 14-Pin (Modified Fm #65314)	ORTEC	ABE #57-60140 (772-0108)

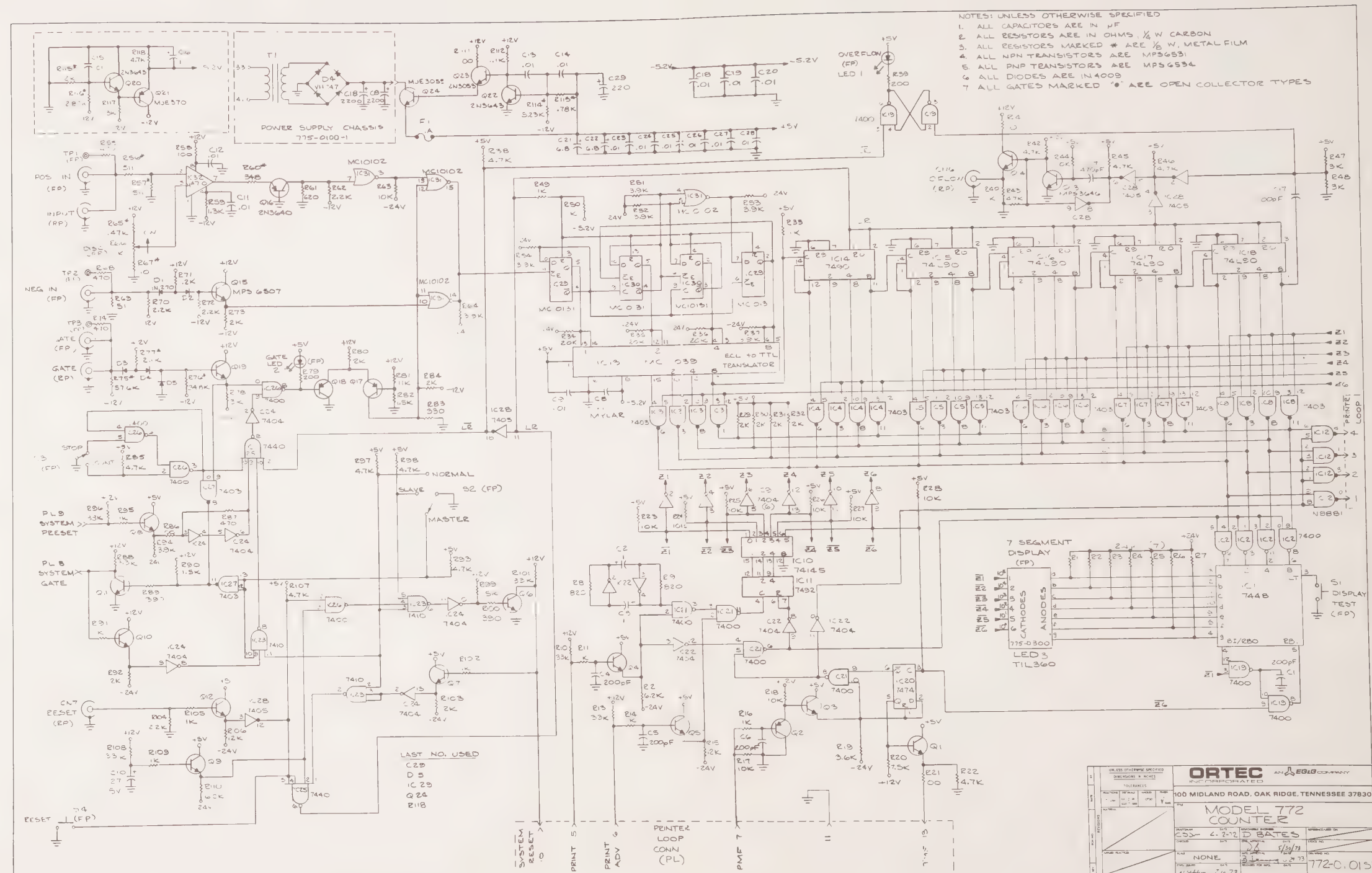
**BIN/MODULE CONNECTOR PIN ASSIGNMENTS
FOR AEC STANDARD NUCLEAR INSTRUMENT MODULES
PER TID-20893**

Pin	Function	Pin	Function
1	+3 volts	23	Reserved
2	−3 volts	24	Reserved
3	Spare Bus	25	Reserved
4	Reserved Bus	26	Spare
5	Coaxial	27	Spare
6	Coaxial	*28	+24 volts
7	Coaxial	*29	−24 volts
8	200 volts dc	30	Spare Bus
9	Spare	31	Spare
*10	+6 volts	32	Spare
*11	−6 volts	*33	115 volts ac (Hot)
12	Reserved Bus	*34	Power Return Ground
13	Spare	**35	Reset (Scaler)
14	Spare	**36	Gate
15	Reserved	**37	Reset (Auxiliary)
*16	+12 volts	38	Coaxial
*17	−12 volts	39	Coaxial
18	Spare Bus	40	Coaxial
19	Reserved Bus	*41	115 volts ac (Neut.)
20	Spare	*42	High Quality Ground
21	Spare	G	Ground Guide Pin
22	Reserved		

Pins marked (*) are installed and wired in ORTEC 401A and 401B Modular System Bins.

Pins marked (*) and (**) are installed and wired in EG&G/ORTEC—HEP M250/N and M350/N NIMBINS.

The transistor types installed in your instrument may differ from those shown in the schematic diagram. In such cases, necessary replacements can be made with either the type shown in the diagram or the type actually used in the instrument.



ORTEC CORPORATION		100 MIDLAND ROAD, OAK RIDGE, TENNESSEE 37830	
MODEL 772		COUNTER	
CDS-4.7-2 D BATES		772-0101-1	
NONE		772-0101-1	

For more information on ORTEC products or their applications, contact your local ORTEC representative or:

Europe: ORTEC GmbH, 8 Munich 13, Frankfurt Ring 81, West Germany, Telephone (0811) 359-1001 or 359-1441, Telex (841) 521-5487

United Kingdom: ORTEC Limited, Dallow Road, Luton, Bedfordshire, England, Telephone LUton 27557, Telex 82477

Other: ORTEC Incorporated, 100 Midland Road, Oak Ridge, Tennessee 37830, Telephone (615) 482-4411, TWX 810-572-1078, Telex 055-7450

MP MASTER



MA29030

ORTEC
INCORPORATED

AN  **EG&G** COMPANY